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Study Finds New Mode JA Operating Practice Desirable

During the early 1980's, AMSAT operations planners studied means of reducing QRM on the Mode B passband caused by Doppler shift. Specifically, it was recognized that the magnitude and polarity of Doppler shift depends on one's location relative to the path of the satellite. It was decided that to minimize disruption and especially to facilitate net operations, a standard practice should be instituted. That practice recommended that to minimize the QRM resulting from various Doppler shift magnitudes, all Mode B stations should adjust only their uplinks to maintain a constant downlink frequency as heard at their own QTH. This tactic worked as hoped and reduced Doppler-induced QRM significantly when employed on AO-10, Mode B.

Now, however, a recent study by WA2LQQ concludes the application of this standard practice to Mode JA has an unexpected and undesired effect. Not only does the Mode B practice not help reduce Doppler-induced QRM on FO-12 Mode JA, but it actually makes the situation three times as bad as it would be if the receiver were adjusted instead of the transmitter.

The difference has to do with the use of the downlink as a pilot frequency. According to the study, when the uplink frequency is higher than the downlink, as it is with Mode B, adjusting the transmitter is the best tactic. Conversely, when the downlink frequency is higher than the uplink, as in Mode JA, the best tactic is to adjust the receiver. Aggravating the situation is the fact that FO-12's relatively low orbit means fairly high Doppler shift and high rate of change of Doppler shift magnitude.

The study will be published soon and its findings will be considered for possible inclusion in a new Mode JA standard operating practice. Although the technical issues seem clear enough, there may be other factors to consider. For although the study indicates an approach which appears technically warranted, its adaptation would require two different operating practices: one for Mode B and another for Mode JA. And then what about the other modes such as A, K, T, L, S and so forth? Although there are only three possibilities, (adjust the transmitter or the receiver or neither), the stipulation of a standard operating practice for each mode could cause confusion and in the end be counterproductive. But having a single practice for all modes is, as the study has shown, at least equally undesirable. AMSAT managers will be asked to sort out the facts and recommend the best approach.

In the meantime, a preliminary recommendation is being made that henceforth Mode JA users adopt the practice of adjusting only their RECEIVERS to stay tuned into the QSO. This will not totally eliminate Doppler shift of the QSO and some minor transmitter frequency tweaking will always be required. But adjusting the receiver will reduce the QSO Doppler shift to one third of what it would be if the transmitted uplink were adjusted as it is with Mode B practice. This will, in turn, reduce passband QRM since the likelihood of "collisions" between QSOs is reduced when there is a general correlation in the Doppler rates of stations using the passband.

Furthermore, the new recommended practice for Mode JA would conform to de facto standard currently used on Mode JD. On Mode JD, the downlink is a single channel whose frequency is independent of the exact frequency of any of stations using any of the 4 uplink channels. This is in contrast to the Mode JA transponder which uses an inverting linear transponder in which a positive frequency shift on the uplink yields a comparable negative frequency shift on the downlink. Thus, the Doppler effect experienced by the Mode JD user is the product of the Doppler shift of only one link: the downlink. The critical difference is that the Doppler shift at 2 meters is one third of the Doppler shift at 70 cm.

Stations using Mode JD typically employ modems with built-in AFC controls that adjust the rf RECEIVER frequency to keep the downlink tuned in. Thus, Mode JD users already employ the recommended practice of adjusting only their JD receivers although not for precisely the reasons Mode JA users will want to employ the new recommended practice for JA.

The study was the result of suggestions by several FO-12 Mode JA users that current practice devised for AO-10 Mode B was unsatisfactory for FO-12 Mode JA. In fact, the study clearly shows both that these individuals were correct and that the magnitude of the Doppler shift resulting from employment of the Mode B standard practice on Mode JD is unnecessarily high.

AMSAT OSCAR 10 Pulled From Service As Sun Angle Sags

AO-10 has been withdrawn from service for about 90 days. The move was necessary due to low battery charge conditions. Reports began to filter in during early August that AO-10's beacon was showing some FMing. Then the transponder shut off several times. This was interpreted as indicating insufficient battery charge to sustain operations at the current level. The decision was then taken on August 11 to curtail operations to reduce the chance of permanent battery damage.

It had been anticipated that, based on estimated sun angles, eclipse duration and transponder user loading, the satellite could be available for use through the end of August. However, due to the heavy recent use combined with uncertainty in the precise attitude of the satellite, the early curtailment of AO-10 operations was required. Lengthening of the perigee eclipses was another contributory cause.

The angle between the solar panels and the sun is currently about – 75 degrees according to the best available estimates. Since electrical power varies as the cosine of the angle, power realized is now about 26% of capacity. As of mid-September the perigee eclipses were up to 60 minutes long further reducing available power.

Controllers are unable to maneuver the satellite's attitude in orbit. This ability was afforded by the IHU energizing the magnetorquers in precise sequence and timing. Since the IHU is inoperative, the satellite's attitude stays fixed with regard to inertial space. However, since the satellite and the earth move around the sun as a system, the attitude of AO-10's solar panels with respect to the sun changes seasonally. We are now approaching the worst season for AO-10 sun angles.

On the positive side, satellite controllers are optimistic AO-10 will again be usable following the eclipses beginning in late Autumn.

FO-12 Celebrates First Anniversary In Orbit With New JD Software

Fuji OSCAR 12 has completed its first full year in orbit and, although it continues to be plagued by a chronic power shortage, new software is about to be loaded into the onboard computer (OBC) to enhance the Mode JD mailbox operation. The load was expected on the weekend of 15 August. Tak Okamoto, JA2PKI, says JR1ING and JR1FIG of JAMSAT released the new version of the FO-12 Mailbox onboard software to JARL for loading. Some of the new features include:

1) The maximum number of messages is increased to 100. If memory for messages is used up, older messages will be deleted and their memory space will be used to record the latest mail. There is 150 kilo bytes of memory space for storing messages.

2) Mail can be deleted by its receiver as well as by the sender. You can save memory space by using K command after reading personal mail sent to you.

3) Trailing blanks after "SUBJECT" are removed and are no longer sent.

New commands included in the new software package include:

1) F<d> command	Show file headers posted on the day specified by <d>. Currently <d> should be decimal number standing for day. Month or year can't be specified. i.e. "F6" means "list files posted on 6th day (of any month, year)".
2) M command (M = Mine)	Show file headers addressed to current user. This command is useful when the user wants to see only his personal mail quickly.
3) B command (B = Bulletin)	Show file headers addressed to "ALL". You can look for bulletin or general information without listing lengthy personal mail headers.
4) U command (U = User)	Show callsigns of users currently logging in to the mailbox. This command is useful when you set your "FRAC" or MAXFRAMES parameters optimum for number of current users. SSID is ignored when listing callsigns.

Refer to *ASR* #150, June 1, 1987, for a complete list of previously available commands.

The FO-12 operating schedule for the period is:

From		To		
Date	Time	Date	Time	Mode
September 06	03:03	07	02:13	JD
09	02:27	10	03:35	JD
12	01:47	13	05:00	JD
15	01:06	16	06:30	JA
17	01:20	18	06:36	JA
19	07:45	21	01:50	JA
22	00:54	22	03:00	JD Note 1
22	05:01	23	04:07	JD
24	05:15	25	04:21	JD
26	03:27	27	04:35	JD
29	02:46	30	03:54	JA
October 01	03:00	02	04:08	JA
03	03:14	05	01:26	JA
07	01:39	08	02:47	JD
09	01:53	10	01:00	JD

The transponders will be off at others times. The schedule may be changed at any time due to unexpected power situations.

Note 1: On September 22 from 00:54 through 03:00 UTC a special telemetry software handler software package will be loaded to permit telemetry transmission every 2 seconds instead of every minute. The mailbox will be unavailable during this period but the digipeater will be operational. Telemetry reports will be appreciated. Send to JARL via the FO-12 mailbox.

Tak says there are still relatively few on Mode JD but that the population is growing. A recent census showed 36 stations from JA, 10 from Europe, 9 from North America, 4 from Oceania and 1 from Africa.

DSP and Phase 4 To Feature At ARRL Midwest Division Convention

The ARRL Midwest Division Convention will be held at the Adventureland Inn in Des Moines, Iowa on September

26-27, 1987. Featured speakers include Dr. Robert McGwier, N4HY, and Ralph Wallio, WØRPK, of AMSAT who will be present seminars on Digital Signal Processing (DSP) and the AMSAT Phase 4 Development Program. Bob and Ralph will be joined by Jim McKim, WØCY, in discussions of current AMSAT topics at an additional seminar on Saturday morning the 26th. AMSAT representatives will staff the AMSAT booth and will be available for continuing discussions on these and related matters of interest to attendees.

Dr. McGwier is AMSAT Assistant Vice President of Engineering. He's involved in several vital technical development projects including Digital Signaling Processing (DSP), Phase 4 attitude control, spread spectrum ranging techniques, advanced tracking systems and advanced packet radio protocols to name just a few. His doctorate is in applied mathematics. He is employed by I.D.A. Communications Research of Princeton. Formerly Bob was a Professor of Mathematics at Auburn University.

Ralph Wallio is AMSAT Vice President of Operations and is currently involved in Phase 4 ground segment development, updating of orbital element processing and distribution and is SYSOP of the WØRPK-AMSAT Bulletin Board System. Ralph is Telecommunications Engineering Manager with Financial Information Trust of Des Moines, which operates one of the largest satellite communications networks.

Jim McKim, WØCY is AMSAT Assistant Vice President of Administration and a Regional Coordinator. He has run the AMSAT Mid-America 75 meter net for more than 15 years. Jim is retired and lives in Salina, Kansas. He was recently featured in a major article on OSCARs in the Smithsonian's magazine, "Air and Space."

DSP is a field which has its roots in arcane mathematics but is now rendered practical and accessible by microprocessors. Cost-effective application of DSP techniques to Fourier analysis, linear systems, ARMA models and finite impulse response filters is now possible. DSP microprocessors are now available from Texas Instruments (TMS320 family) and Motorola (DSP 56000), which have been complemented with required peripheral devices on IBM-PC compatible boards ready for application programming.

DSP techniques are successfully used in many military and commercial signal analysis applications. The breakthrough to Amateur Radio is now at hand. Seemingly advanced and difficult-to-realize applications such as ACSSB (amplitude compandored SSB), digitized voice over packet radio networks, high speed modems, spectrum analysis and QRP moon bounce are but a sample of the prospects at hand. Remarkably its all done in SOFTWARE! DSP techniques also lend themselves very well to the more mundane tasks of producing complex bandpass, lowpass and highpass filter characteristics. An optimal and adaptive woodpecker filter that can "tune" to different pecking rates is achievable.

Bob's DSP presentation will be augmented by demonstrations of applications developed for Amateur Radio in the areas of spectrum and weak signal analysis, frequency synthesis, digital filtering and a BPSK demodulator. An IBM-PC environment, a DSP board costing a few hundred dollars and sophisticated software will duplicate capabilities which formerly required racks of equipment costing tens or nundreds of thousands of dollars. AMSAT and TAPR (Tucson Area Packet Radio) have joined in a new project to bring DSP techniques to bear on Amateur communications problems. The project is headed by Bob and Dr. Tom Clark, W3IWI.

AMSAT's Phase 4 Development Program is approaching its goal of fully describing the requirements and solutions of orbiting and operating a geosynchronous OSCAR spacecraft and deploying and operating an extensive multimode user network. AMSAT leadership is now defining the path for bringing Phase 4 on line in the early 1990s.

Ralph will review advances in OSCAR technology which have paved the way towards this geosynchronous effort. Operational goals will be discussed including the need for a radical increase in the quality and quantity of Amateur Radio public service activity and the productive use of the UHF spectrum. Use of the UHF spectrum is vital to Amateur Radio's continued access to bands in this now extremely valuable turf. Discussion will include ground segment networking concepts and alternative technologies.

Bob will present information on spacecraft systems development including stabilization, thermal control, attitude control and transponder characteristics. Phase 4 promises to be a significant engineering achievement with applied leading-edge technologies such as fluid momentum control (FMC), heat pipe thermal distribution, a reaction control system (RCS) and the potential of transponder bandwidths exceeding 1 MHz.

These discussions are supported by the Des Moines Radio Amateur Association (DMRAA), the Central Iowa Technical Society (CITS) and AMSAT. The convention seminar schedule for Saturday September 26th includes:

0900-1000	Packet radio by CITS
1000-1100	1st AMSAT session by WØCY, N4HY and WØRPK with topics including AO-10, FO-12, RS-10/11, PHASE-3C and EDSAT
1500-1600	2nd AMSAT PHASE-4 session by N4HY and WØRPK
1600-1700+	DSP session by N4HY
Sunday	
1000-1100	VHF-UHF Review by WØCY

For more information concerning the ARRL 1987 Midwest Division Convention direct inquiries to MIDWEST CONVENTION, P.O. Box 12065, Des Moines, IA 50312.

Phase 3C Launch Campaign Poised For Kickoff

With about 6 months to go until launch, AMSAT is preparing to kick off its Phase 3C launch campaign. This program will include special tutorials on getting to know Phase 3C and its four transponders, two of which are unprecedented. There will be special promotional items and brochures for handouts at conventions, hamfests and club meetings.

Among the first projects to get started in the Launch Campaign will be the Phase 3C Insurance Project. AMSAT will be purchasing launch insurance to protect our investment in the spacecraft. AMSAT members will be invited to par-

ticipate by making a tax-deductible contribution to the Phase 3C insurance fund and receive a handsome Phase 3C memento in return. Watch for details of the Phase 3C Launch Campaign Kickoff in early September.

QEX is a monthly technical magazine published jointly by AMSAT and ARRL. It is an ideal vehicle for Phase 3C "Getting To Know You" type articles which are too long and detailed for *ASR* but of more general interest than found in *AMSAT's Technical Journal*. Articles for *QEX* on Phase 3C (and other technical matters) are very much needed at this time.

Volunteers are sought to handle various aspects of the Phase 3C Launch Campaign Program. Articles need to be written, projects need to be coordinated and various tasks need to be addressed. Contact AMSAT Headquarters if you are interested in working on the Phase 3C Launch Campaign Program.

AMSAT Phase 3C will ride of the Ariane V-22 mission. The next Ariane launch, V-19, is currently slated to liftoff on September 15.

Heavy Seas Delay Saint Paul Island RS-10/11 DXpedition

A satellite DXpedition to Saint Paul Island off the east coast of Canada, originally planned to begin August 10, was postponed at least 10 days due to poor weather conditions on the travel route. According to DXpedition organizer Don Roland, VE1AOE, heavy seas around Saint Paul Island on August 12 prevented their approach to the desired location on the island. Heavy swells forced their retreat and they returned to Cape Breton on August 13.

The DXpedition status was unknown at presstime (23 Aug.). When they do take up station on Saint Paul Island, they will operate for 3 to 4 days. Don says they will operate primarily RS-10 and 11 but may give FO-12 a shot too. Saint Paul Island is located at 47.1 N, 60.1 W and is a 3 hour boat ride from Cape Breton, Nova Scotia, the last stretch of which must be accomplished by rowboat for lack of an acceptable harbor or mooring. All three DXers are from Truro, Nova Scotia, 60 miles north of Halifax. Watch for their special callsign, CY1SPI, and QSL to VE1AOE.

More Updates On RS-10/11 Antenna Configuration

Updating an earlier news item on the RS-10/11 antenna configuration, G3IOR says there are 4 Amateur Radio antennas aboard Cosmos 1861, the host spacecraft of RS-10/11. He says there are one each 2 meter 1/2 wave verticals for RS-10 and RS-11. A 10 meter 1/4 wave ground plane is switchable between RS-10 and RS-11. Finally, a 15 meter 1/4 wave ground plane is used by both RS-10 and RS-11 15 meter uplink receivers. G3IOR adds it appears the frequencies of both transponders are drifting upwards and are now 5 to 7 kHz higher than specified.

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Ian Ashley, ZL1AOX, spoke at the AMSAT UK/University of Surrey Colloquium.

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